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ABSTRACT

Two decades of research on the external efficacy of educational investments in developing countries have produced a persuasive rationale for expanding access to schooling and raising educational attainment levels. Schooling has been associated with such outcomes as the following: (1) rationalistic attitudes conducive to participating in modern production and governance institutions; (2) profound cognitive changes resulting from using written language and adopting new technologies; (3) involvement in the market economy; and (4) lower fertility rates, good nutritional practices, and better health. There are several explanations for schooling's impact, including those stressing the social organization of schooling, secular literacy as a cognitive development process, and human capital and social discontinuity theories. These explanations implicate the school curricula, literacy, instructional organization, and the articulation of schooling with the wage economy as some mechanisms through which individuals change and societal benefits occur. The literature reviewed in this paper has been divided into four sections corresponding to different school outcome domains. The first section comprises studies of schooling's modernizing effects on individual attitudes. The second section reviews research on the effects of school-acquired literacy and numeracy on cognition. The third and fourth sections survey research on the relationship between schooling and employment, earnings, productivity, and benefits such as improved health, nutrition, and fertility control. Conclusions and implications are discussed at length. (110 references) (MLH)

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THE CONSEQUENCES OF SCHOOLING: A REVIEW OF RESEARCH ON THE OUTCOMES OF PRIMARY SCHOOLING IN DEVELOPING COUNTRIES

by
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The Consequences of Schooling:
A Review of Research on the Outcomes of Primary Schooling In Developing Countries

Twenty years of research on the external efficiency of educational investments in developing countries have produced a persuasive rationale for expanding access to schooling and raising levels of educational attainment. Schooling has been associated with such outcomes as: rationalistic, empirical attitudes that are conducive to participation in modern institutions of production and governance; profound cognitive changes resulting from the use of written language, and facilitating adoption and use of new technologies; involvement in the market economy, leading to increased earnings and higher levels of productivity in agriculture and wage employment; and lower fertility rates, good nutritional practices, and better health.

At least four sets of explanations have been offered for the impact of schooling. Each draws attention to different features of school experiences. The first explanation emphasizes the social organization of schooling, its similarity to complex organizations of production. This explanation developed from the structuralist tradition in contemporary North American sociology. More specifically, it is derived from the research of modernization theorists whose concern was to describe the

relationship between social institutions and social change in a way that would account for the new forms of social relations that developed in response to colonialism, capitalism and the introduction of machine-based modes of production into non-western agrarian societies. Schools seemed to many modernization theorists to be an important source of new attitudes and behaviors and, thus, an accelerator of social change. Modern attitudes acquired from secular instruction as well as from the social organization of schooling prepared individuals to enter a society based on employment, income, and participation in social networks that had little to do with the affiliations of kinship and traditional forms of subsistence.

The second explanation, also drawn from modernization theory, identifies secular literacy as the stimulus for cognitive changes that enable individuals to process a wide range of scientific and technological information. At the center of this explanation are assumptions about the relationship between language and thought and between instruction and the skills that are required to make use of products and processes of modern science and technology in daily life. Schooling is presented as an institution that exposes pupils to novel cognitive tasks that facilitate widespread access to products of modern science and technology, use of which requires processing of printed information for self-instruction. Literacy is presumed to enhance an individual's capacity to benefit from technologies linked to contemporary notions of a better life.

A third explanation focuses on the training and socializing functions of schooling and on the value added to an individual's productive skills. Education is viewed as analogous to land, labor and capital, i.e. as a factor of production that generates wealth, and also as the means by which the social relations of production are reproduced as well as transformed. Human capital theory is the most ideologically accommodating and, perhaps for this reason, the dominant expression of this perspective. The first uses of human capital theory focused on qualitative improvements to the labor force, assessing the relation of increases in schooling to economic growth, and making few assumptions about how schooling might improve productive skills.

Subsequent refinements to human capital theory made individual investment decisions the object of analysis and enabled comparisons between alternative educational investments. The labor market established the value of schooling principally in the form of earnings received. Increments in lifetime earnings were attributed to amounts and kinds of education, and benefits to individuals calculated and assumed to represent benefits accrued to society. The ability to use technology to increase the efficiency of productive resources is believed to be imparted by the school curriculum as well as by the social organization of instruction. What is learned, especially from what is formally taught, is considered as having an intermediate effect on employment and, ultimately, on earnings. This will vary with length and quality of instruction, and with the

correspondence between schooling and the kinds of training and experiences that are valued in the labor market. How schooling develops the social skills needed in the formal employment sector is more difficult to study. Nonetheless, these skills (e.g., dealing with non-familial authority) are considered important in accounting for the development of productive capacities.

The fourth explanation stresses the impact of schooling on status aspirations and consumption patterns. Reference is made to the social discontinuities created by schooling which are central to its function, as Margaret Mead once put it, turning "the child of the peasant into a clerk, of the farmer into a lawyer ... of the illiterate into the literate" (Mead 1943, 639). Intergenerational changes in social roles arise from the historical connection between schooling and either wage employment or, more generally, the monetary economy. Schooling exposes pupils to a wide range of social and occupational roles. Notable among them are those within the school system (i.e., teachers and administrators) which allow a standard of living that is enviable in rural areas in many developing countries. It is argued that this results in a scramble for the educational credentials that are the means of entry into formal employment. Formal employment, in turn, provides the wherewithal to satisfy the expectations schooling generates; disposable income to purchase consumables including medicine, modern health care, nutritious food, and better education for children. What schooling imparts, in brief, is not only notions of a better life

but the means through which this can be achieved, both educationally and in terms of the social conditions that help to satisfy material aspirations. Perhaps the most important of these conditions is residence in an urban area where a greater variety of consumer goods, and health, educational, and social services are available. Associated with this lifestyle is the nuclear family and the adoption of fertility control technologies to reduce family size. Although the importance of social and material betterment is taught in a formal sense, it is the examples that schooling provides that are perhaps most influential.

Plan of Study

The above explanations for the effects of schooling implicate the school curricula, literacy, the organization of instruction, and the articulation of schooling with the wage economy as some of the mechanisms through which individuals change and benefits to society occur. Most research on school outcomes employs at least one of these explanations, and usually more than one, to account for measurable changes in individual behavior or for aggregate social benefits.

The literature that will be reviewed has been divided into four sections corresponding to different domains of school outcomes. The first section comprises studies of the modernizing effects of schooling on individual attitudes. Modernization theory accorded schooling a central role in the process of social

change and sought to relate the length and content of schooling to attitudes and behaviors that are the objects of development planning. In formulating individual modernity as an universalistic concept and detaching it from the specific features of the intellectual culture of any society, modernization theory afforded little possibility for understanding differential responses to schooling or to social change. Studies of individual modernity have been largely abandoned except by some educational economists, and are viewed by many contemporary researchers with silent embarrassment. Nevertheless, the principal findings of this research continue to permeate thinking about how schooling might influence adult behavior.

The second section reviews research on effects of school-acquired literacy and numeracy on cognition. Literacy and numeracy are treated as outcomes rather than, simply, intermediate effects, because they involve cognition in ways that may enhance capacities to satisfy basic social and material needs. The third and fourth sections survey research on the relationship between schooling and employment, earnings, productivity, and such benefits as improved health, nutrition, and fertility control. These school outcomes are, however, affected by many factors including those related to gender and ethnicity as well as how societies are politically organized.

Wide variations in the extent to which school-acquired capacities are realized in satisfying aspirations for a better

life are concealed when individual benefits are aggregated. Female cultivators, for example, may not realize benefits from primary schooling if they do not have disposable income for purchasing medicines to reduce infant mortality, or agricultural chemicals that may raise their productivity, even if schooling has made them more capable of using products and processes derived from modern science. Moreover, a useful distinction may be made between the school effects that are discernible at an individual level and essentially attitudinal and cognitive, and the instrumental benefits to society with which they are intuitively associated. Although these are usually combined in the rationale educational research has developed for investing in primary schooling, it is important to recognize that studies which have established the powerful attitudinal and cognitive effects of schooling can only suggest what social benefits might result. Similarly, studies of social and economic benefits attributed to schooling do not trace the process by which individuals have been changed by their school experiences.

The four domains surveyed in this paper are essentially those considered in an influential study of the external efficiency of school investments prepared for the World Bank by Colclough, who argued for increased investment in primary education (Colclough 1980). Many of the sources Colclough reviewed are reexamined and the findings brought up to date. This paper does not take issue with the proposition that familial and public resources should be directed to the expansion of

primary schooling in developing countries. That issue was decided long before researchers expressed interest in determining whether this was the most efficient use of educational resources. School enrollments in developing countries have greatly increased at the primary level and many of them are near to providing universal primary education (Patel 1985). What may have been achieved is considered in subsequent discussion.

Attitudinal Outcomes of Schooling

When colonial societies were becoming independent in the 1950s and early 1960s, there was a great deal of concern about the future of the newly implanted participatory political institutions which metropolitan countries had created. Economic growth was considered a necessary but not a sufficient condition for political stability. The argument that "education would change the level of individual psychological functioning to make possible changes in economic and political activity," note the authors of a recent reassessment of early research in cross-cultural psychology, "fit(s) perfectly with long-standing American beliefs in the importance of a well-educated population to the proper functioning of a democracy" (Dias et al. 1986, 1050).

The educational implications of modernization theory are associated with the writings of Inkeles who constructed a psychometric profile of the "modernity syndrome" (Inkeles and

Smith 1974). The profile was developed for two purposes; first, to determine whether there were attitudes that characterized modernization in individuals, and second, to examine sources of influence on the acquisition of modern outlooks. The modernity syndrome presumes a graduated set of responses to modern institutions and influences that ranges from affirmation of customary pre-industrial beliefs ("tradition") to the adoption of values of instrumental importance in modern society that may be in conflict with those inherited from previous generations. Modernity is associated with the integration of pre-capitalist, agrarian societies into a world economic system originating in the economic and social transformations that took place in Europe and North America in the 19th and 20th centuries.

Individual Modernity

Inkeles' modernity syndrome was operationalized as responses to a set of interrelated scales that measured attitudes towards new technologies and experiences, independence from familial and communal authority, allegiance to institutions of secular authority, faith in western science, values relating to social mobility, beliefs about control of the future, interest in civic and political affairs, and cosmopolitan concerns with events outside the realm of family, community, and kinship group (Inkeles 1966, 1973a, Inkeles and Smith 1974). Responses to more than 180 questions were aggregated into an Overall Modernity score (Smith and Inkeles 1966). A score of 100 could be

achieved by the "most modern men" by responses that, for example, indicated a knowledge of (and, presumably, a readiness to use) contraceptives, disagreement with the proposition that children should always obey their parents, or willingness to protest a bad government proposal. A "traditional" man would be likely to know little of birth control, place importance on child obedience, and accept governmental proposals as being beyond his ability to influence. Despite persistent criticism of the ethnocentricity of the concept of individual modernity (Portes 1973) and the acknowledged weaknesses of psychometric approaches to the study of social processes (Godwin 1974), the concept is important for the insight it affords into the affective changes schooling may bring about.

Modernization research sought to connect school experiences to the development of capacities having to do with the ways individuals work, interact with complex institutions, and make use of secular, scientific knowledge in daily life. Researchers were content with measuring these capacities with instruments that elicited attitudes whose connection to the behaviors they represented was only inferred. Still, attitudinal transformations have some intuitive relationship to why investments are made in schooling. Such transformations are central to the rhetoric of school syllabi in many developing countries, especially in socialist countries which are usually less reticent about promoting social change (though society rather than individuals is the object of these transformations).

Affective changes attributed to schooling may not predispose people to do things differently, be sufficient for changes in behavior to occur, or indicate competencies individuals may not have otherwise possessed or developed. But schooling is a powerful social experience, influencing how individuals think about themselves in ways that are valued in various developmental ideologies.

Comparative Studies of Individual Modernity

Many studies were carried out using the Overall Modernity scale in the 1960s and early 1970s in countries as diverse as Argentina, Brazil, Chile, India, Israel, Nigeria, and the United States. Modifications of the scale are still used in educational research on many topics ranging from studies of the impact of schooling on receptivity to science popularization programs, to the application of school knowledge and skills in peasant agriculture (See, for example, Tiku 1985 and Jamison and Moock 1984).

The initial administrations of the modernization scale with national samples of (mostly male) adolescents and adults with less than eight years of schooling in Argentina, Chile, Bangladesh, India, Israel, and Nigeria established that each year of schooling increased modernity scores by slightly less than two percent (Inkeles and Smith 1966). Compared to other modernizing influences such as urbanization, factory experience, and exposure

to mass media, the effects of schooling were more profound and more consistent across the various national data sets.

Holsinger's study is perhaps the most methodologically convincing of the modernization studies as his findings for school effects do not conceal the possible influence of maturity and socio-economic background, and data was also collected from school children over a five-month period showing a substantial rise in scores between administrations (Holsinger and Theisen 1977). How much schooling is necessary to bring about a shift from tradition to modernity? The answer, of course, depends on the beliefs and values with which a child enters school, and that are acquired from and reinforced by the home environment, though there is some evidence that the effects of schooling are more pronounced for children from more disadvantaged, and, thus, supposedly more "traditional" backgrounds (Holsinger 1973). It depends also on the modernity of the school environment and the school curricula, as well as on the intellectual capacity of the child to integrate new information and experiences. Most of the studies of school adults with low incomes in non-western countries suggest that substantial affective change requires relatively high levels of schooling, i.e. at least a complete primary education. Adults with seven or fewer years of schooling achieved scores clustering around the mid-point in the modernity scale (e.g. Sack 1973). A full secondary education generally raised scores to the upper third of the scale, high enough to be unambiguous evidence of modernity. At what point additional

schooling would have diminishing effects on modernity is unclear (Holsinger and Theisen 1977).

Inkeles identified four processes associated with school learning as being crucial to school effects: reward and punishment, modeling, exemplification, and generalization (Inkeles 1973c). Reward and punishment is connected to the socialization of children into the sequential routines that are a part of classroom life, and of modern society by implication. According to Inkeles, such experiences teach the principle of planning. The contact of children with figures of authority within the school, particularly with teachers, leads to imitative behavior involving the expression of modern values and forms of conduct. The school in exemplifying these values and behaviors encourages their acceptance. Generalization is learned with the development of personal capacity through competent performance of related cognitive tasks in different subject domains. These processes operate within institutions where: learning activities are organized in terms of sequential, hierarchical tasks; instruction is segmented to foster mastery; mastery is assessed with respect to universalistic criteria; and authority relations are based on demonstrations of ability.

Modernity research was not conceived so that these and related hypotheses could be examined directly. That would have involved a much more detailed characterization of the educational experiences of students than psychometric and survey approaches allow, and more explicit treatments of the connection between the

content and processes of social learning at school and the attitudinal and behavior outcomes under investigation. However, some studies do provide disparate insights into the gross effects of different educational experiences and instruction characteristics on individual modernity.

Program Outcomes

The modernizing effects of academic, vocational, and technical education were examined in several studies. Evidence of the importance of the instructional program which a student undertakes is provided by Armer and Youtz in their study of modernity among Muslims in northern Nigeria, where comparisons between secular and Koranic education established the modernizing effects of government schooling and also indicated the importance of academic instruction in secondary grammar schools (Armer and Youtz 1971, 620). Individuals with similar levels of schooling who attended teacher training colleges or technical institutions were less likely to score highly on modernity measures. Because of selective recruitment into the various types of post-primary institutions, these results could be attributed to "intelligence," the student's social and economic background, and other predisposing factors. The curriculum seems to be implicated in these differences notwithstanding selection bias. The lower scores of schooled adults with more exposure to Koranic education points to this and, in light of the reliance on

recitation in religious education, to the importance of "problem solving" methods of instruction in academic subjects.

Sack's study of vocational training in Tunisia also suggests that its effects on modernity are negligible, though he attributed this finding to the limited duration of such instruction ("eleven months (is) not enough to impart ... modernizing values") rather than to its methods or content (Sack 1973, 269). Recent studies comparing the modernity scores of students in academic and prevocational programs in Colombia and Tanzania reach a different conclusion. In these countries, vocational training is more modernizing (Psacharopoulos and Loxley 1985). It may be tentatively concluded that the interaction between subject and method of instruction accounts for some of the differential effects of schooling in modernizing attitudes, although how and under what circumstances is unclear.

Effects of Achievement and School Environment

The relationship of formal knowledge and scholastic performance to modernity is crucial to an understanding of whether it is the structure or the content and associated instructional processes that are responsible for affective change. Unfortunately, the findings on this issue are also ambiguous. As noted earlier, when Inkeles deleted information items from the modernity inventory, the correlation between years of schooling and modern attitudes was unaffected. Moreover, when

Holsinger compared increases in modernity scores with information test scores of Brazilian primary school students, he found that while annual knowledge gains were slightly larger (7.1 vs. 5.1), "the school does nearly as well at its subconscious, informal, and implicit task of modernizing as it does in meeting its explicitly stated task of imparting certain kinds of knowledge" (Holsinger 1973, 193). Other studies show a high correlation between modernity and graded academic performance (for example, Cunningham 1973). Grades measure mastery of school knowledge as well as social competence (valuing mastery and acting accordingly). In an interesting analysis of teacher assessments of a student's initiative, ambition, desire to learn, responsibility, and leadership, Cunningham demonstrated that these correlated more highly with the grade point average of Puerto Rican secondary school students than with their modernity scores.

Few studies investigated the effects of the school environment on modernity despite the fact that this is central to Inkeles' explanation of how individuals in traditional societies become modern. Among the exceptions are Holsinger's Brazilian study to which reference has been made above, and Susman's survey of Black migrants to Boston (Susman 1973). Inkeles recognized that school characteristics could enhance or limit its socializing effects. Unless the school environment exemplified modern values and self-consciously fostered their acquisition by children, affective change might not be discernible --- in

extreme cases, the school caused children to reject these orientations. If a pupil's school experience, Inkeles noted, is "one of continuous frustration, failure and rejection, (then) insofar as this pupil generalizes from his school experience ... it will hardly be by way of feeling more efficacious or more open to new experience" (Inkeles 1973b, 178). In Brazil, Holsinger showed that modernity scores were variable across classrooms at the same grade level. In one of the classrooms studied, pupils' modernity scores actually declined between administrations of the survey instruments, while others had increased by an average of more than five points (Holsinger 1973, 193). Holsinger does not explain this anomaly. In a subsequent study, he examined the effects of teacher modernity, physical environment, teacher negativism, sociometric structure, and classroom climate on pupils' modernity (Holsinger 1976). A combination of the five indicators of school quality was found to be "a substantially better predictor of both Modernity and more traditionally tested achievement items than ... Socio Economic Status" (Holsinger and Theisen 1977, 324). However, the aggregation of qualitative factors as disparate as these into a single measure makes it difficult to draw meaningful implications.

The chief strength of modernization theory is that it proposed to explain how capacities for technological change were formed and linked schooling to school outcomes of economic and political importance, at least in a speculative sense. Its chief weakness, evident in the concept of individual modernity, was its

inherent and objectionable ethnocentrism. Put perhaps much too simply, the idea of individual modernity and the modernization theory from which it was derived were very close to the ideology of colonialism as well as to the premises of decolonization. Africans and Asians were, understandably, not flattered by modernization theory with its presumption of the superiority of western political, economic, and social institutions and values. Imbedded within the modernization theory were doubts which were expressed more overtly in the colonial period.

Another important weakness of the modernity research is that it offered little more than speculation as to the causes of affective change in the school environment. Significantly, the modernizing characteristics of schooling were substantiated with North American theories and examples. How much personal capacity is fostered, for instance, in primary school systems in many developing countries where wastage may account for a fourth to a half of the entering cohort, and in which less than a third of those who finish primary school will gain admission to secondary schools? What opportunities do students in impoverished rural schools have to develop independence, responsibility, or initiative when there are few textbooks for them to study from, and achievement is determined by performance on national examinations set with reference to a national syllabus that teachers have difficulty in covering? It is possible to accept the claims made in the modernity studies for the effectiveness of schooling without correlative explanations founded upon

generalizations from developed to developing countries. Schooling in developing countries may indeed impart modern values but in very different ways. Simply attending school on a fairly regular basis is a demonstration of personal capacity in many countries.

The Cognitive Consequences of Literacy

In a recent review of literacy research, Kaestle remarked that while much is known about how literacy developed in modern western countries and there has been much speculation about its contribution to social and economic changes in these countries, much less is known about the uses of literacy in everyday life that may facilitate the transformation of societies (Kaestle 1985, 45). Instead, debate has necessarily centered on the association between rates of individual literacy and historical changes in the organization of production. 18th and 19th century Europe and North America are used as illustrations of what may be achieved in contemporary developing countries by making primary schooling universal and eradicating illiteracy through adult education programs.

However, the lessons that can be extracted from western experience are unclear. The contribution of literacy to an agricultural revolution in the late 18th century and to an industrial revolution in the mid 19th century is, of course, difficult to assess in the absence of better evidence of literacy

than signature studies can provide. Whether literacy and the cognitive and social skills acquired incidental to learning to read and write enabled the individuals to adopt or to adapt to machine-based production technologies cannot be determined retrospectively. What is clear, though, is that an increasing proportion of European and North American populations were becoming literate through schooling at the same time that important, lasting changes were taking place in production methods which accelerated capital accumulation and stratified societies, both internally and internationally (Oxenham 1980).

Almost twenty-five years ago Bowman and Anderson postulated that a 40% literacy rate might be a threshold level for high rates of economic growth in developing countries (Bowman and Anderson 1963). It is often forgotten that this formula, invoked in support of the universalization of primary education and the organization of literacy campaigns in developing countries in the 1960s, was accompanied by a warning that these measures were no prescription for economic growth. Public education, literacy, and the introduction of new production technologies form a complex ecology and the individual elements cannot be interjected in the expectation that substantial economic change will result.

Today levels of educational attainment in Third World countries are approaching the historical position of western Europe in the 1950s, attesting to the enormous expansion of primary and secondary education especially in Latin America and Asia (Patel 1985). But except perhaps in the so-called newly

industrializing countries (for example, Hong Kong, South Korea, Taiwan, and Thailand), this has not been accompanied by a proportional increase in living standards (Hicks 1980). The historical connection between literacy and the satisfaction of basic material needs that is assumed in the rhetoric of educational expansion in developing countries, particularly in Africa, is increasingly less convincing in the light of significant school leaver unemployment, declining per capita agricultural production, and endemic poverty. Such negative evidence is, however, no more informative than the inferences that have been made from the historical experience of developed countries. What is needed is a better knowledge of what changes in cognitive capacities accompany the acquisition of literacy, and what uses individuals make of literacy acquired from schooling and from other sources. Early correlational studies such as Bowman and Anderson's used schooling to measure literacy levels, and literacy to explain the influence of schooling. The school's efficacy in imparting literacy, and the long-term retention of literacy skills, were assumed without serious scrutiny, as was the proposition that the associated cognitive skills were permanent.

Literacy and Cognition

Goody and Watt, in an influential essay on the social changes resulting from mass literacy, made an important distinction between the intellectual operations necessary for

literacy and those used in ordinary speech (Goody and Watt 1963). Comprehension and production of written text, they said, required explication of formal logical structures --- specifying the relationships between events, for instance --- that in speech could be imputed or implied from knowledge external to the frame of discourse. Development of alphabetic systems, Goody and Watt speculated, facilitates intellectual discovery and cultural innovation particularly where literacy is widespread. Literacy and numeracy are considered basic to functioning in a modern society. Numeracy, the ability to perform arithmetic operations, differs from literacy in the sense that comprehension and production tasks are analytically identical. But like literacy, numeracy requires that symbolic knowledge be integrated into formal structures for purposes of comprehension and production.

The impact of modernization on cognition was investigated by the Soviet psychologist Luria who studied nomadic and peasant societies in Central Asia. These societies varied in their response to the collectivization schemes that transformed traditional production and permitted extension of schooling into areas previously resistant to schooling and other "modern" influences. Luria examined the reasoning of individuals who were affected by collectivization and compared them to those who were not. He "found striking differences in the way these two populations responded to verbal syllogisms" (Cole et al. 1971, 185). His studies proposed that patterns of cognition could be

changed by a powerful combination of modern influences; technology, new forms of production, literacy, and schooling.

John Gay, who collaborated with Michael Cole in a study of the Kpelle society of Liberia, examined the cognitive effects of schooling (Gay and Cole 1967). He compared unschooled to schooled Kpelle and both groups to American high school students. The performance of schooled Kpelle was similar to that of American students on experimental tasks thought to involve "universal" cognitive skills. Kpelle who had not been to school and were illiterate had difficulty in sorting and classifying familiar objects and did poorly on verbal tasks measuring more complex skills in inferential reasoning. However, Gay doubted that these findings were evidence of the cognitive deficits that the term illiteracy implies. Unschooled Kpelle agriculturalists used complex cognitive processes in solving a wide range of problems which were meaningful to them; for instance, in estimating weight and value of agricultural produce. They performed poorly on school-like tasks that were presented as hypothetical problems, necessitating an ability to infer rules from individual cases. Unschooled Kpelle were hesitant to employ this mode of reasoning, at least in experimental situations.

In later research, Cole established that "moderate levels of education led to performance that American research has found to be characteristic of a higher development level" (Cole et al. 1971, 224). Moderate education (the completion of two to six years of schooling) increased skills in discriminant learning and

in solving word problems. Although earlier studies suggested an experiential explanation for different intellectual structures and processes for integrating knowledge, it was now unclear whether the tasks characteristic of school instruction prompted the cognitive changes observed, or whether these were related to literacy which could be acquired outside school (Cole and Scribner 1974).

Formal and Informal Acquisition of Literacy Skills

A major five-year research project was begun in 1973 to study the cognitive effects of various ways of acquiring literacy among the Vai of Liberia, a Muslim society and one of the few in Africa to have evolved a script for an indigenous language. Vai speakers were of special interest because they may become literate in English in school, in Arabic in Koranic school, or in Vai as a result of self-initated, informal learning. Analyses of performance related to categorization, memory, logical reasoning, encoding and decoding, semantic integration, and verbal explanation indicated that "literacy is not a surrogate for schooling with respect to its intellectual consequences" (Scribner and Cole 1981, 252). English schooling enhanced performance on almost all outcome measures except those which modeled tasks that were associated with Vai and Arabic script learning, such as incremental recall. The effects of English schooling were most apparent in tests of verbal explanation, including facility in communicating information and solving

syllogisms. "We have no reason to believe," Scribner and Cole observed, "that skills required to explain why these problems were answered in a certain way are fostered by knowledge of a written language..." "Rather," they concluded, "they strike us as being exactly those skills that are acquired in a teacher-pupil dialogue in the classroom" (Scribner and Cole 1981, 255). Rather oddly, Scribner and Cole invoke the findings of micro-ethnographies of teacher-student dialogue in American classrooms to substantiate their speculation that skills in verbal explanation are acquired in the explanatory learning tasks which are a prominent feature of instruction: "What made you give that answer? How do you know?" etc. That such dialogue is a prominent feature of classroom instruction in Liberia was not established.

Elsewhere I have shown that skills in comprehending written texts are influenced by the student's familiarity with the subject of the text as well as with the instruction the student has received in interpreting similar texts (Eisemon 1988). A comparison was made between primary school age children in coastal Kenya who had completed a madrassa education and other Muslim children who attended government schools and had little exposure to traditional religious instruction. The study indicated not only that madrassa graduates excelled in recall tasks with religious texts, but that they performed better than other children in the comprehension of material taught in science classes that required high level inferences from the texts or

from prior knowledge. The superior performance of madrassa graduates was attributed to more frequent exposure to printed information, and to the emphasis placed in religious learning on drawing ethical applications from principles, thereby developing skills which may be transferred to other domains. Similar findings are reported by Wagner whose studies of Koranic education in North Africa suggest that it has a positive influence on later schooling (Ezzaki: Spratt and Wagner 1987, Wagner 1986). These findings contradict the assumption that school-acquired literacy necessarily promotes "problem-solving" skills irrespective of the circumstances of instruction. Kenyan children who lacked a religious education which fosters a disciplined study of texts, and who became literate only at school, did poorly on measures of inferential reasoning. Such reasoning has little importance in a teaching environment which is oriented to preparing children to recall information for national examinations.

The distinction between literacy and school effects is of considerable importance in light of the findings from studies of cognitive skill retention among school leavers (Dias et al. 1986). These have cast doubt upon the long-term effects of even substantial school instruction on retention of literacy and numeracy skills. Retention studies are difficult to carry out for many reasons. For example, retention should be studied longitudinally; but this is seldom possible. Consequently, cross-sectional approaches are used in which comparisons are

drawn between the performance levels of students and school leavers. An example is Simmons' study of Tunisian urban workers. About half of Simmons' sample, who were presumably literate in French and Arabic when they left school, had lapsed into illiteracy or semi-literacy after about five years, i.e. they were unable to read or understand a national newspaper. Almost the same proportion could not do simple arithmetic operations involving multiplication and division (Simmons 1976, 86).

Scribner and Cole's subjects who had been to government or Koranic school were not tested for literacy. Self-reported literacy sufficed as a criterion for the assignment of subjects to literacy groups. There is no way of knowing what proportion of schooled Kpelle might be "functionally" illiterate or semi-literate as Simmons' defined these terms. However, it is likely that the proportion is very high given the fact that Scribner and Cole's study population covered a much wider age range (from less than twenty years to fifty years and older, compared to ages fifteen to twenty-five), and was composed mainly of individuals residing in towns and villages in rural areas where literacy skills are less apt to be a part of daily life (Scribner and Cole 1981, 292-4, Simmons 1976, 90). However, the cognitive effects of schooling may be more enduring than the literacy and numeracy skills that schooling may impart if these effects are understood in a broader sense, in terms of cognitive strategies which may be developed by formal instruction.

Measuring Literacy Retention

In most educational research, literacy is considered quite simply, as the ability to recall and integrate factual information from a written text that a school child should be capable of understanding. Tasks created to assess comprehension of written texts in test situations typically combine factual recall (with the text present) and "problem-solving" exercises requiring inferences from propositions. The tasks are assumed to be nominally equivalent for individuals of similar age and educational experience. The strength of this approach is its simplicity and the fact that it permits differentiation of the school age population in terms of information processing skills that are highly correlated with school achievement. Its chief weakness is that the text comprehension tasks may have little to do with literate performance that is meaningful to most people, including school children (Street 1984; 1987).

The problem of nominal equivalence of literacy tasks is particularly acute with respect to the assessment of literacy retention among adults (Chall 1987, Cole and Means 1983). Simmon's study of Tunisian urban workers, which has been mentioned above, used sixth grade students as the control group for measuring literacy losses. In other words, text and tasks that were comprehensible to these students should be understood by adults who had left school after completing sixth grade. School control groups have been used for many studies of literacy retention, and five or six years of primary education seems to be

the base line adopted in most of them (Hartley and Swanson 1984, 33-37). Some studies have attempted to differentiate retention by year of schooling. An International Development Research Centre project in the Philippines, for example, measured retention of basic skills by testing achievement in English, Philippino, and mathematics in each grade level, and comparing individuals who left school to grade specific norms (EDPITAF 1980). Not surprisingly, a higher proportion of adults who terminated schooling after one year were "illiterate" than those who continued to the third grade. A majority of primary school leavers were found to have "lost" skills (Hartley and Swanson 1984, 36).

Interestingly, numeracy skills were more apt to decline than comprehension and production skills in the mother tongue or in a foreign language. The findings that skill loss decreases with more years of schooling and that numeracy skills are more easily lost are corroborated in other investigations (for example, Roy and Kapoor 1975, Sheffield 1977). While there is no agreement in these studies as to how much schooling or adult literacy instruction is needed to make literacy permanent, speculation centers on four to six years of schooling, and slightly less in the case of adult literacy programs.

More recent research has challenged the notion of a threshold level beyond which literacy becomes permanent. In a study of Egyptian primary school dropouts and students attending school, Hartley and Swanson have suggested that the "striking

flatness of the (literacy) retention curves and the fact that the curves of dropouts from lower grades actually rise renders moot most arguments concerning threshold levels." "Rather than lapsing into illiteracy," they argue, "the children with the lowest level of skills are likely to build upon the few skills they have mastered in school" (Hartley and Swanson 1984, 5). The authors propose that four years of primary schooling are needed to make an individual functionally literate in the opinion of Egyptian educators (Hartley and Swanson 1984, 6). An important feature of Hartley and Swanson's analysis is that the lower skill levels of dropouts were taken into consideration. In other words, they lost less literacy than is commonly supposed because they exhibited less competence in literacy tasks while in school. Among the factors which showed the strongest relationship to skill retention were the individual's health status and parental socio-economic status. School variables "were relatively less important" though level of teacher-training and good school facilities had some positive effect (Hartley and Swanson 1984, 11). But as in previous studies of literacy retention, no effort was made to connect performance measures to observed instructional experiences or to determine their meaning to adult literates.

In three studies of uses of literacy in daily life, I have suggested that retention rates may be higher than is often assumed due to the fact that adult literates process written text differently than school children, especially if the subject

matter is familiar and meaningful. Two studies carried out in coastal and western Kenya among adults with at least six years of primary schooling examined skills in comprehending commercial instructions on the use of pharmaceutical products and agricultural chemicals (Eisemon 1988, Eisemon and Nyamete 1988a). In contrast to school children, adults perform poorly on comprehension tasks assessing facility in recalling or inferring from factual information from the text. They are, however, more likely to use prior knowledge --- much of it acquired in school --- to comprehend written text. Although adult literates were found to read English, Kiswahili, and mother tongue text with little difficulty, and to recall school acquired knowledge of mathematics, science, health science, and agriculture needed to comprehend the texts, they often did not make correct inferences. School-acquired literacy did not make them functionally literate if they did not understand what they were taught in school. Schooling imparted basic skills but not necessarily an understanding of the concepts required for their successful application. This difficulty was traced to instructional methods suited for large classes, limited learning resources, and the preparation of students for national examinations which develop a knowledge of scientific and technical vocabulary without much understanding of the principles and processes involved (Eisemon, Patel and Abagi 1987). The small sample did not permit an analysis of the loss of skills over time among individuals with different levels of schooling. Nor was it possible to estimate

how much schooling was required to comprehend commercial instructions though individuals with two or more years of secondary education generally performed better. Preliminary findings from a related study of Masai mothers' comprehension of instructions for oral rehydration therapy indicate a similar pattern. A relatively high level of schooling is necessary to impart the basic understanding of biological and physical processes that is necessary for the safe and effective use of this treatment. Again, some secondary education seems to be a prerequisite for truly functional literacy (Eisemon, Patel and Ole Sena 1987).

Efforts to study the retention and use of literacy skills have suffered from a lack of accepted definitions of literacy, disagreement as to what level of facility enables literacy to become a permanent, self-sustaining skill, and dissension over what constitutes functional abilities (Wagner 1987).

Nevertheless, three conclusions emerge from the foregoing discussion. First, literacy seems to be a source of the profound cognitive, affective, and behavioral changes that have been associated with formal schooling. These changes arise from the lexical and semantic features of printed texts and the skills required to comprehend them as well as from processes of instruction and the knowledge acquired incidental to becoming literate in school. Second, literacy retention among school leavers may be underestimated because the methods used to measure literate performance of adults do not take into account the ways

adults process information from printed texts. Third, the development of literacy and the high-level cognitive skills with which it is intuitively related are influenced by qualitative characteristics of instruction such as the availability of printed texts, and their use by teachers to encourage problem solving and inferential reasoning in acquiring secular knowledge.

Economic Benefits of Educational Investments

Estimating the economic benefits of educational investments has been the principal object of studies that assess the external productivity of school systems. These studies involve calculating rates of returns to such investments based on data on individual earnings. School related increases in earnings are explained by the contribution of education to the acquisition of vocational skills and knowledge including "reasoning skills (and) changes in beliefs and values and in attitudes toward work and society" (International Bank for Reconstruction and Development 1980, 47). Such skills, knowledge, beliefs, values, and attitudes raise the productive capacities of the labor force by enabling a more efficient use of production technologies and physical capital, in general. The value thus added to an individual's capacities is viewed as fairly uniform for levels of educational attainment, and will stabilize or increase at a constant rate over the individual's productive life, varying with

capacities possessed upon entry into the labor market. The contribution of education to more efficient utilization of all factors of production is acknowledged in the form of higher incomes and, in the case of wage salary employment, in the practice of remunerating workers according to their levels of schooling. Both practices are seen to measure the relative productivity of labor inputs. The evidence adduced in support of the proposition that schooling increases productive capacity and, hence, economic growth, uses qualitative improvement of the labor force to account for most unaccounted-for growth (Schultz 1961, 1963, Denison 1962), or seeks to explain the variation in national growth rates attributable to the level of human resource development (Hicks 1980), or measures how much additional output is created by combining investment in physical capital with educational investments (Wheeler 1980, Marris 1982).

Rate of Return Analysis

The theory of rate of return analysis assumes that earnings measure productivity and earnings functions are an individual's equilibrium price. An individual will continue to invest in schooling as long as earnings benefits (private return) exceed returns from alternative investments. Rates of return to society's investments in schooling (social return) are projected from earnings functions on the assumption that increased earnings attributable to incremental increases in levels of schooling are redistributed through differential taxation and public

expenditures to produce social benefits. A third measure is being developed to (better) assess the benefits accruing from government investments in schooling. It takes into account the opportunity costs of student subsidies and other direct income transfers. This measure, the fiscal rate of return, "views investment from the point of view of the government, rather than society as a whole" (Psacharopoulos and Woodhall 1985, 139-140). Its use in a recent study of higher education in Chile strengthened recommendations to reduce government subsidies and introduce cost recovery measures in order to bring private rates of return into line with the usually lower benefits to government and to society. For a more thorough discussion of rate of return models, see Blaug (1967), Thias and Carnoy (1972), Psacharopoulos (1972, 1975, 1980, 1981, and 1985), and Psacharopoulos and Woodhall (1985).

Since the early 1970s, rate of return analysis has been employed by the World Bank to guide its educational lending to developing countries. The World Bank commends this type of analysis to planners as an instrument for evaluating individual projects, the distribution of subsidies within the educational system, the profitability of allocations to education compared with other sectoral expenditures, and as a base for extrapolating the future impact of present patterns of investment.

While these analyses do not reveal very much about how schooling might increase productivity, or about the conditions that maximize use of school-acquired knowledge and skills, they

do create a compelling argument in favor of increased investment in education. In addition, rate of return analyses provide a normative data on patterns of educational expenditure indicating how a country ought to make investments among levels and programs within the educational system. They direct attention to sources of social inequalities and to corrective measures. High private rates of return to public investments, especially in secondary and higher education, suggest, besides the adoption of cost recovery measures (higher tuition fees, the substitution of loan schemes for direct subsidies, etc.), more comprehensive, more effective, and more progressive taxation of income. They cast judicious doubt on the efficacy of "supply side" solutions to manpower shortages by emphasizing the rationality of individual investment decisions. Even in economies in which the public sector is the predominant employer and where some variant of manpower planning is practiced, little will be accomplished in correcting aggregate or geographical shortages of skilled labor by expanding opportunities for training without commensurate changes in the remuneration associated with occupations deemed critical for national development. Finally, rate of return analyses promote concern for the quality of preparation that individuals receive for entry into occupations as well as for structural imperfections in the labor market that create chronic disequilibrium in the production and demand for skilled labor.

The findings of international comparisons of rates of return to educational investments are well-known:

1. Rates of return to educational investments are well above the 10 percent yardstick commonly used by developing countries to indicate the opportunity cost of capital.

2. The returns to education in developing countries are higher than the corresponding returns in more advanced countries.

3. The economic benefits of educating women are generally higher than for men.

4. Private returns are in excess of social returns, especially at the university level.

5. The returns to primary education (whether social or private) are highest among all educational levels (Psacharopoulos and Woodhall 1985, Psacharopoulos 1985).

While these findings are important for investment decision making, they have been perhaps more influential in substantiating the belief that educational investments in neo-capitalist economies disproportionately subsidize the economically advantaged segments of the population, who are the most likely to receive the limited opportunities for secondary and higher education.

As an instrument for guiding educational policymaking at the national level, rate of return analyses have been criticized for producing rather vague prescriptions for resource allocation. However, present applications of the technique that examine the profitability of alternative investments using earnings data collected from tracer studies, increase the utility of rate of return analyses as a decision making tool. This is a major

improvement on previous analyses that aggregate costs and income benefits across education levels which, especially in developing countries, vary enormously in the range of their objectives and in their articulation with the so-called modern sector of the economy. In addition, explicit attention is now given to the qualitative outcomes of different programs of study to take into account variations in ability among graduates who enter the labor market with different qualifications.

Investing in Academic and Vocational Education

Two recent studies by Psacharopoulos and Loxley are of special importance in regard to investments in academic and vocational education (Psacharopoulos and Loxley 1985). Studies conducted in Colombia and Tanzania compare academic secondary education with diversified secondary education in which students are exposed to prevocational subjects. The programs were compared with respect to the social background of students, their performance on examinations measuring academic and vocational knowledge, their propensity to continue formal education, and their employment and initial earnings on graduation. Estimates of the social rates of return to investments in academic and diversified secondary education indicate that the latter are not "significantly more or less profitable as an investment" (Psacharopoulos and Woodhall 1985). The high costs of prevocational training in both countries, the narrow range of public sector salaries for secondary school graduates of all

types in Tanzania, and the very wide range in income among Columbian graduates which reduced differences in mean earnings were among the factors cited as responsible for the similar rates of return (Psacharopoulos and Loxley 1985, 210-228).

Interestingly, performance on vocational knowledge tests was influenced not only by the amount of instruction but also, in Tanzania, by the level at which the school introduced vocational training: the earlier it was begun the higher the students' performance. Although data on the interrelationship of measures of (verbal and mathematical) aptitude, achievement, employment, and earnings were not presented for Tanzania, the Colombian study indicated that "no one factor, even academic achievement, was shown to have a significant effect on earnings" (Psacharopoulos and Loxley 1985, 109). The employment and earnings data from which this finding is derived are incomplete and limited to information obtained in 1982 from 1981 graduates. Yet it is of considerable importance inasmuch as earnings differentials are hypothesized to represent differences in productivity based on skills and knowledge developed through formal instruction. Inferences made about the value added to productive capacities by increments of schooling are founded on the notion that progression from one stage of education to the next is determined by demonstrations of ability that have some relationship to work. This premise may need to be reexamined if it is consistently shown that ability has little to do with the differences in economic benefits obtained from further study.

Education and Income Differentials

Why do employers raise the levels of educational qualifications required for employment and pay individuals accordingly if these practices are not related to differences in productive ability? Several controversial explanations have been proposed, focusing on the signaling (Spence 1973) and screening (Arrow 1973) functions of schooling for the labor market. Expressed perhaps too simply, such explanations propose that employers overvalue schooling because they use it to sort out individuals for employment rather than to reward productive skills. A variant of this explanation proposes that employers reward social skills that are associated with increased levels of schooling but may have no obvious relationship to production or even to the social competencies necessary for work in complex organizations. Strong objections to the sorting hypothesis have been expressed by Psacharopoulos, who claims that there is little evidence that employers continue paying wages above a worker's productivity after an initial period of observation (Psacharopoulos and Woodhall 1985, 45). However, his studies provide little support for the alternative ability hypothesis, though the absence of longitudinal data on earnings makes any conclusion tentative.

Simmons' 1974 study of sources of income differentials among Tunisian blue collar workers revealed that earnings had more relationship to work experience than to schooling, and that while

literacy was associated with income it did not explain much of the variance in earnings (Simmons 1974). The study is significant because individuals in the occupations examined possessed a wide range of educational credentials. Comparisons of earnings differentials across occupations are not particularly insightful inasmuch as the effects of schooling are confounded with the relationship between schooling and occupational recruitment (Hinchliffe 1976). Simmons' instruments incorporated crude measures of cognitive skills employed at work (e.g. Did they read and write on the job?). "With the exception of the variable 'reads newspapers'," Simmons concludes, "the use, or the ability to use, school skills outside the factory is not related to earnings" (Simmons 1974, 8). Although the supporting evidence is weak, Simmons' findings indicate that the proposition that schooling increases earnings after initial employment needs to be tested on occupations which are fluid with respect to the educational qualifications needed for entry. In most developing countries, particularly those in which a large share of the labor force is employed in the private sector, there is considerable variation in earnings across occupational categories. In Bogota, for example, the income ratio between workers with higher education and workers with no schooling is 11:1 in sales jobs, as compared to 4:1 in production and 5:1 in technical occupations (Fields 1980, 50). Moreover, the variation in income ratios between well-schooled and unschooled workers across industries is even greater; 25:1 in agriculture, 11:1 in retail trade, etc.

(Fields 1980, 52). In other words, even if earnings differentials actually measure productivity, the influence of schooling is so varied for individuals with similar qualifications that it is probably necessary to first specify its effects for particular occupations and industries, and then examine their antecedents in particular kinds of instructional experiences and learning outcomes (Boissiere, Knight, and Sabot 1985).

The latter course of study will require development of measures of knowledge and skills that are valid not only with respect to what students are expected to know and do at the end of a program of study, but also in relation to what is required of them in occupations and work settings where they are likely to find employment. Some part, possibly a very large part, of the knowledge and skills acquired at school is transferable from one work domain to another and rewarded differentially. But even literacy skills are not as easily generalized across domains of instruction as educators previously thought (Bloome 1987). Nor are they apt to be uniformly applicable to different forms of work involving literacy. An association between schooling, literacy skills, and earnings will not tell us much about the kinds of instruction employers value when they hire and increase the earnings of school literates, and what should be done to better prepare students for the labor market. Skills and knowledge gained incidental to becoming literate in school may be even more important.

The screening hypothesis gives schools an influential role in the development of social competence that machine-based methods of production and socially diverse productive organizations require. Conjecture as to the nature of these skills has centered on behaviors which have to do with skills in interacting with non-familial authority (Bowles and Gintis 1976). It is difficult to accept the implication that authority relations skills are better learned in school than on the job, or that they have a linear relationship to levels of schooling. There may be other social skills which are essentially cognitive, are much more complex and are more likely to be learned from formal instruction. A survey in western Kenya of highly remunerated factory occupations which do not require literacy, numeracy, or school knowledge for performance, revealed that most positions were filled by school leavers despite employers' preferences for unschooled workers (Eisemon et al. 1986). Ethnographic analysis of these occupations established that what was common to all of them was that job performance depended on meticulous compliance with sequential work procedures. An extreme example concerned positions connected with the preparation of quarry sites for blasting, and jobs which involved regular maintenance of heavy machinery. Workers in these occupations did not use school knowledge and skills in any formal sense. They did, however, perform complex school-like procedural tasks. Attempts to measure related cognitive skills in comprehending procedural information among school children

demonstrated that length of primary schooling was associated with competence. In short, the relationship between schooling, employment, and occupational performance may be more subtle than the association of indicators of schooling, occupational status, and earnings suggests.

Limitations of Rate of Return Analyses

Many objections have been raised to the use of rate of return analyses for estimating individual or social benefits accruing from educational investments. Some of these objections have been addressed by improvements in the quality of data. Attempts have been made, for example, to control for student ability in selection to academic and technical secondary education and to take account of the impact of educational expansion of unemployment. The findings of recent studies strengthen previous claims. For example, an Indonesian comparison of academic with vocational education established higher returns to academic instruction for male, urban graduates, even under assumptions of higher, temporary unemployment (Clark 1983, 46). Some objections are inherently difficult to address in any satisfactory way. Rate of return analyses equate costs with benefits at the time data were collected, and even sophisticated extrapolations based on time series data may provide a poor indication of what future returns might be after major educational investments have been made. This objection

applies, of course, to any strategy of rationalizing and planning investment.

A more serious objection is that in light of the constraints on obtaining comprehensive data on individual earnings, rates of return are almost always calculated with income estimates for individuals employed in the formal sector of the economies of developing countries. Not only are the "incomes" of individuals (especially women) in the subsistence sector usually ignored, but the earnings of educated workers in the non-agricultural informal sector in rural and urban areas are seldom estimated with precision, largely because of the assumption that workers have only one occupation from which they obtain income (King 1977). A recent household survey of informal sector employment in a rural area in western Kenya revealed that most workers combine participation in peasant agriculture with many forms of casual and sometimes permanent employment (Shiundu 1986). The majority of rural primary school leavers and many secondary school graduates in Kenya have little opportunity for permanent employment and enter the loosely defined informal sector where the value placed on educational credentials has perhaps a closer relationship to productivity than it does in the government dominated formal sector which is the object of development planning. Informal sector earnings may not be as low as is often thought (ILO 1972). The average combined earnings of individuals who were described in this survey as self-employed, were well above the estimated average earnings of urban skilled workers.

While Kenya is atypical of African countries in having a relatively high level of prosperity in rural areas, enabling a development of a large informal sector (accounting for, in the district studied, about 30% of adult employment), similar situations can be found in other parts of the developing world. The rapidly expanding informal sector greatly limits the use of conventional income estimates in rate of return analyses. Moreover, in many developing countries with income policies that reduce earnings differentials between skilled and unskilled workers in the public sector, income estimates for the formal sector are becoming increasingly unreliable. An undetermined but probably very high proportion of public sector workers in countries like Ghana and Tanzania, for example, hold several jobs simultaneously and/or use their formal employment to generate informal income. Advocates of rate of return analysis recognize the biases in earnings estimated from government sources and have attempted to correct them in sample surveys to the extent that more comprehensive self-reporting of income is requested (Heyneman 1984). Objections about the quality and interpretation of earnings data are countered with the contention that individual benefits to schooling would probably be greater if income could be better estimated. How social benefits would be affected is more difficult to determine.

Impact of Schooling on Production

Evidence relating to the impact of schooling on physical output is more convincing than uses of income estimates to measure productivity. Unfortunately, there is very little evidence of school effects on industrial output where it is possible to make comparisons between workers in similar jobs who have different levels of education. Factory-level studies tend to place importance of work experience as the major factor affecting a worker's earnings as well as output (e.g. Fuller 1975). However, the findings of these studies are usually oriented to testing the screening hypothesis rather than to examining the use or lack of use of school knowledge and skills. (For a summary, see Berry 1980, 201-202.)

Several studies summarized by Rathgeber have investigated the use of school-acquired craft skills in the formal and informal sectors (Rathgeber 1986, Shiudu 1986, Ndua 1985, Oyeneye 1980). These have shown that few workers use vocational skills taught to them in schools; vocational skills are generally acquired on-the-job (usually through apprenticeship); and that whether individuals make use of formal or informal vocational training is strongly influenced by factors unrelated to their training, such as the availability of capital. The teaching of pre-vocational and vocational skills has been severely criticized. Schools often lack the necessary equipment "which would have provided (students with) the opportunity to develop some manual skills" (Rathgeber 1986, 9). Comparisons of the

acquisition of craft skills in and outside of school have also drawn attention to the complex tasks associated with competence in craft production, and to the difficulties in acquiring important skills through formal instruction. A recent study of instruction in soapstone carving in primary schools and in families of soapstone carvers in western Kenya, for instance, indicated that high-level skills in plastic representation are developed through spontaneous learning experiences involving careful observation of demonstrations of competent task performance (Eisemon, Hart and Ong'esa 1988). Such experiences are rarely possible in school. Moreover, while school instruction in craft skills is predicated upon a linear development of skills, progression from one level to the next being dependent upon factors other than individual task competence, outside school processes of skill acquisition are less linear and hierarchial but more rigid in the sequence of activities that contribute to competence. In contrast to school children who develop skills in producing objects of little or no economic value in the belief that these skills are somehow generalizable, children learning crafts outside school are producing objects for sale with scarce materials and valuable tools. This has serious implications for whether children acquire skills in efficient use of materials, skills that may be fundamental to successful self-employment, especially in cottage industries and the kinds of artisan production which are important in rural areas.

Education and Agricultural Productivity

More supportive, more insightful evidence of the productivity-raising effects of schooling is to be found in the literature on education and agricultural productivity (Lockheed et al. 1980, Jamison and Lau 1982, Jamison and Moock 1984). A number of studies summarized by Lockheed, Jamison and Lau (1980) correlate schooling with what are represented as significant increases in crop production. In eighteen developing country studies, farmers with some primary education (four or more years) produced almost 13% more crops than farmers who had not been to school when non-skill inputs affecting crop production were controlled (Jamison and Lau in Psacharopoulos and Woodhall 1985, 46). The effects of schooling on agricultural productivity, especially in an investigation of the crop production practices of farmers in Thailand, seem to be mediated by choice of and skill in using production technologies (Jamison and Lau 1982, 195-222). For example, each year of schooling was estimated to raise output by 2% and 3% if chemical fertilizers were applied (Jamison and Lau 1982, 10). Similar estimates of productivity increases per year of schooling were obtained for South Korea although comparisons of mechanized and non-mechanized farms did not, for reasons which are largely unexplained, indicate a stronger impact of education on productivity under technology intensive conditions. In many of the studies reviewed by Jamison, Lockheed and Lau (1980), four years of schooling of the

"head of the household" is considered to be a threshold for productivity effects. The head of the household, in most of the countries studied, is likely to be male while in at least some of them --- Kenya, for instance --- the cultivators responsible for selecting and using modern production technologies, though perhaps not for purchasing them, are apt to be women, who usually have lower levels of schooling.

The more recent data from South Korea suggests that when the educational level of all adult members of the household is taken into account, school effects on efficient use of production technologies and higher agricultural output may be greater (Jamison and Lau 1982). But this varies from country to country. The educational level of households in Thailand is not related to productivity on farms using chemical fertilizers (Jamison and Lau 1982, 131). What these findings emphasize is the importance of linking estimates of school effects to information in the sexual and generational division of labor in peasant agriculture, and to household decision making regarding selection of production technologies.

Risto Harma has proposed a model describing how formal schooling may increase agricultural productivity. On the basis of interviews with extension officers and observations of farmer entrepreneurs in Latin America, Harma identified four stages of agricultural productivity and the knowledge and skill requirements associated with each stage. At the first level, traditional farming involving use of local varieties and

technologies, some elements of numeracy are required; minimally, addition and subtraction (as reported by Heyneman in Habte et al. 1983, 16). At the highest level of agricultural technology, which is associated with the use of high-yielding varieties, fertilizer, tubewells, and irrigation, reading comprehension and written communication are necessary as is knowledge of elementary chemistry, biology, physics, and the ability to interpret as well as to make use of new information. These cognitive requirements roughly approximate the academic content and instructional objectives set for primary education in developing countries, most of which have for many years given primary schooling a practical orientation suited to modern agriculture.

Two studies can be considered to be tests of Harma's model, and their findings are not encouraging. The first comprised a review of research to determine whether literacy influenced the adoption of modern farm practices (Villaume 1977). Data from India and Brazil were used to construct a model to assess the contribution of schooling and literacy to agricultural innovation. The findings indicated that the direct and indirect effects of schooling and literacy were negligible in comparison to size of land holdings and income, "a clear indication of the necessity of considering socio-economic opportunity in explaining adoption (of agricultural innovations)" (Villaume 1977, viii). Non-formal learning (involvement in agricultural extension programs, for example) had more impact than schooling (see also Kalirajan and Shand 1985). The second study, an observation of

the effects of farmer education on farm efficiency in Nepal, concludes that neither literacy nor measures of agricultural knowledge are highly associated with technological adoption or agricultural output (Jamison and Moock 1984). Numeracy was found to have a positive effect on productivity but only for the use of fertilizer and the production of wheat.

Notwithstanding the weak evidence of effects of measures of school knowledge and skills in raising agricultural productivity, the rates of return to rural education have been estimated for South Korea, Malaysia, and Thailand to range from 10-26%, depending on prices for farm products and the time when benefits are assumed to begin (Jamison and Lau 1982, 225). The apparent contradiction may say more about the way in which literacy, numeracy, and retention of agricultural knowledge are studied than about their effects on agricultural production. How school knowledge and skills are integrated into agricultural practice is a very complex topic that does not easily lend itself to survey research. Experimental studies of the effects of schooling on the comprehension of instructions for the use of agricultural chemicals, indicate that literacy and school knowledge influence the safe and appropriate use of these products, and that misuse accounts in part for the large variation in yields on peasant plots as well as for the high incidence of chemical poisoning in rural areas (Eisemon 1988, Eisemon and Nyamete 1988a). Measures of functional literacy are more highly correlated with farm output than years of schooling, especially for the production of

food crops, which may be more responsive to variations in capacities to use modern inputs (Eisemon and Nyamete 1988b).

Effects of Education on Health and Fertility

The correlation of maternal education with lower child mortality is sufficiently well documented to require only brief comment. Caldwell (1979), summarizing the findings on Asian and Latin American studies in addition to his research on Nigerian mothers, observes that:

> maternal education is the single most significant determinant of ... marked differences in child mortality. These are also affected by a range of other socio-economic factors, but no other factor has the impact of maternal education and in their totality, they do not even come close to explaining the effect of maternal education... So important is it that it goes far towards mitigating the child mortality impact of the presence or absence of medical facilities in the area of residence (Caldwell 1979, 408).

The effects of maternal education in this and much other research is consistently positive with mortality declining sharply with more than four years of maternal schooling, and the largest reductions occurring among mothers with ten or more years (Caldwell 1979). Caldwell cautions, however, that over time, the relative impact of maternal education may lessen "because those with higher levels of schooling or in white collar occupations are no longer such a highly selected elite" (Caldwell, 1979, 404). Nevertheless, a recent World Bank review of research on

infant mortality concludes with the prescription that "an additional year of schooling for a mother results in a reduction of 9 per 1,000 in the mortality of her offspring" (Cochrane 1980, 92). The husband's schooling produces a much smaller effect; less than half. These findings are supportive of efforts to educate women and keep them in school longer.

Two World Bank reviews of research, which present a comprehensive analysis of the sources of school effects on health and fertility, will be drawn upon in subsequent discussion. Smaller families, healthier mothers and children, and longer life expectancy are usually viewed as important externalities of educational investments. Research on these topics does not, however, easily lend itself to deriving formulations relating to, say, the reduction in family size that will accrue from an additional year of formal schooling. Compared to the effects of other development investments that improve living conditions, school effects are usually much smaller but they strengthen the influence of more significant factors such as access to health and social services (Leigh 1983, Moock and Leslie, 1985). The World Bank reviews present causal models accounting for the direct and indirect effects of schooling which focus attention on the affective changes brought about by schooling, the impact of school-acquired knowledge and skills, and the aspirations generated among school leavers for paid employment and a better life that is more often available in the urban, formal sector of developing economies. The direct effects of schooling are, of

course, of the most interest since they may be manipulated by educational policies.

Education and Health

O'Hara's model of the effects of education on health which is presented in a 1980 review identifies two channels through which schooling influences health practices: first, it increases participation in the monetary economy, and some of the income thus obtained is used to purchase food, housing, and medical care; second, schooling provides individuals with the knowledge and skills to efficiently utilize medical services and other resources that improve health (O'Hara in Cochrane 1980, 35; Cochrane, Leslie and O'Hara 1982). Elaborating on the possible effects of health instruction O'Hara comments:

> Different kinds of education may, of course, operate through these channels in different proportions. A knowledge of diesel engine repair would presumably operate through high income, while training in home economics is designed to operate through non-market activity. The latter, however, usually includes some coursework dealing with health, which presumably should be especially effective in increasing health through non-market channels (O'Hara 1980, 35-36).

In a footnote to this observation, O'Hara expresses regret that "for policy purposes, this presumption can scarcely be tested using the existing literature because information on type or content of education is rarely available in conjunction with health data" (O'Hara 1980, 36). Indeed, the model he proposes for analyzing the household "production" of health includes

measures of parental levels of education, income, and expenditures and no measures of the amount of instruction received in health and related topics, or the knowledge or skills developed and retained from such instruction. Commenting on the findings of studies correlating schooling with improved health, Grosse (1982) cautions that "there is as yet little evidence that changes in policies with respect to health bring about changes in health status or even that changes in the amount or distribution of education result in health status changes." "We need to know more," he adds, "about what kinds of education affect health and to what extent. Are people better off if the focus is on school attendance - and what dimensions, time, attainment, etc.?" (Grosse 1982, 105-106).

Studies of mothers' acceptance of primary health care interventions have indicated that while school instruction seems to influence beliefs about the causation and treatment of children's illnesses, it may not produce the understanding that is presumed in the use of modern medicines or in the adoption of nutritional and other practices associated with better health (Eisemon, Patel, and Ole Sena 1987; Eisemon and Patel 1988). Mothers with high levels of schooling who have participated in adult health education programs have difficulties in performing the seemingly simple procedures involved, for instance, in the administration of oral rehydration salt solutions. Mothers with complete secondary education are often unable to explain why the solutions are necessary and effective and sometimes combine this

treatment with other harmful measures such as administering traditional purgatives and discontinuing feeding. School instruction was found to be an important source of confusion about effective treatment of diarrheal dehydration.

Two studies have examined how school experiences can be organized to facilitate learning of health knowledge relevant to changing health practices. Both deal with instruction in diarrheal diseases. The first showed that "knowledge about prevention, appropriate treatment, and need for referral in cases of diarrhea can be effectively passed on from authors (of action oriented health lessons) to teachers, and then to students, parents and neighbors" (Rodhe and Sadjimin 1980, 1351). The second study correlated changes in methods of assessment used in Kenyan primary schools with explanatory instruction in health science and better student understanding of the causes and treatment of diarrheal dehydration in infants (Eisemon, Patel and Abagi 1987). The findings of these studies suggest that the positive effects of schooling on health can be strengthened if the process through which school knowledge and skills influence health practices is better understood.

Education and Fertility

The need for a better understanding of instructional processes and outcomes to guide policy intervention is even more apparent in the models proposed to explain the effects of schooling on fertility behavior. Cochrane's review of research

on fertility (1979) identifies several channels through which education affects family size; specifically through increasing the number of live children mothers have, reducing the demand for children, and promoting the use of birth control technologies (Cochrane 1979, 7-9). The indirect effects of schooling on infant mortality have been alluded to above. Schooling also makes a direct contribution to increasing fertility by nourishing and looking after the basic health requirements of students, and in the long run, raising the health status of parents and infants. Subsidized distribution of milk and food at school, government boarding schools, compulsory immunization of school age children, provision of free health services in school, and so on, have obvious importance for the nutritional status of children, the control of debilitating and life-threatening communicable diseases and, thus, for female fertility. Although Cochrane did not review research on the impact of these measures, it is likely that expansion of access to primary schooling together with the use of schools as informal health care delivery systems have appreciably influenced both health (Caldwell and Caldwell 1985, Levinger 1986) and fertility. Much of the increase in life expectancy and population growth rates in the colonial period has been attributed to the introduction of western medicine and modern nutritional practices through mission schooling (e.g. Halley 1957, 138-143). These direct school health inputs have significant indirect effects as well. Malnutrition has been associated with student dropout (Hartley

and Swanson 1985) and with low achievement (Selowsky 1976, Jamison and Lockheed 1984).

Schooling may reduce the number of children in more straightforward ways. Men and women who attend school for long periods of time marry later, have children later, and have "more choices about their lives (affecting) their decisions to marry and at what age" (Cochrane 1979, 98). These effects are clearly influenced by school characteristics and policies and are reinforced by local customs relating to dowry or bride prices. In many developing countries, as is the case in a large number of western countries, marriage and schooling represent exclusive choices at least up to the compulsory school leaving age or to the age at which free, universal schooling is provided. This applies even more strongly to continuing schooling and having children. Women who become pregnant at school are often compelled to leave school, at least for the duration of their pregnancy and often forever (Eisemon 1988). Since a number of developing countries make provision for single sex secondary education and/or support boarding schools, women's chances of getting pregnant are minimized. The impact of these practices on lifetime fertility can only be conjectured. Evidence of the direct effects of schooling on fertility are rather ambiguous (Cochrane 1979, 99). Insofar as females of secondary school age are concerned, evidence of lower fertility does not necessarily imply lower lifetime fertility. Education lowers fertility by reducing the span of child bearing years, but this seems to be

cancelled out by, among other things, changing attitudes towards postpartum abstinence and prolonged breast feeding, as well as by the greater likelihood of conception and infant survival due to other effects of schooling.

Another channel through which education affects fertility is through its influence on the demand for children (Cochrane 1979, 100-113). Here the evidence is somewhat less ambiguous. "Education," Cochrane concludes, "is inversely related to ideal family size" (Cochrane 1979, 114). Education is related to perceived ability to afford children but also, not surpisingly, to "higher perceived costs of (having) children" (Cochrane 1979, 115). How education affects the ability to afford children has been considered earlier; schooling increases the propensity for wage/salary employment. Thus, its effects are primarily expressed, Wheeler concludes in an eleven country study of income, fertility, and female education, in "the degree to which the society has already made significant investments in education" (Wheeler 1984, 162).

How education affects perceptions of the costs of having children is another matter. Several studies Cochrane reviewed and more recent research have indicated that educated, employed women, especially in high income households, were more sensitive to the costs of having a large number of children (e.g. Chang 1976, Birdsall and Cochrane 1982, LeVine 1987). Schooling has an important indirect role to play in this as well. Schooling increases the desire for further education for the recipient and

for his or her offspring, and may also increase the desire for higher quality education (Wheeler 1984). In many developing countries, pre-primary education, schooling beyond the secondary level, higher education, and quality education at all levels --typically access to instruction in a metropolitan language which has been adopted for secondary and/or higher education -- is offered in the private sector or is only partly subsidized by government. Though the associated costs are widely recognized as substantial and increase with the obligation to educate all children to a level that their ability and the family's financial means allow, the impact of these costs on desired family size or on the actual number of children of schooled parents remains to be systematically investigated.

A third channel through which schooling affects fertility, according to Cochrane, has to do with its impact on knowledge about and practice of birth control (Cochrane 1979, 116-140). The studies considered by Cochrane show that "education increases contraceptive knowledge in a stronger and more uniform manner than it improves attitudes toward contraception... Education increases contraceptive use, but this relation is slightly less uniform than that for contraceptive knowledge" (Cochrane 1979, 139-140). The effects of education on contraceptive knowledge cannot be simply attributed to school instruction, nor are they in the studies of South Korea and a number of Latin American countries which Cochrane selects for detailed analysis. Schooled men and women of child bearing age are more apt to have access to

a wide variety of contraceptive information from printed and other media, and more exposure to health clinics and adult education programs.

Reproduction information is, however, taught in primary and secondary schools in many developing countries. The effects of this instruction on acquiring knowledge relevant to contraception, like the effects of instruction in health and nutrition, are seldom formally evaluated either in the context of student achievement in biology or in fertility studies, except in reference to the number of birth control techniques an educated individual has heard of. Yet the knowledge and skills schooling imparts may be crucial to the successful use of contraceptive techniques. Although relatively safe reversible birth control techniques are available for women (and men), dangerous and irreversible techniques such as injection and sterilization are favored by family planners and foreign donors for developing countries for reasons having to do with perceptions of their suitability for poorly educated or unschooled rural populations (Eisemon 1986). Self administration of birth control pills, for example, is a more complex task than it is often assumed to be. Some understanding of how the pills act to control fertility is required, as is confidence in pills as a treatment modality. The strong relationship between secondary and higher education and contraceptive use --- 50% to 100% higher than for women with only primary education --- may have less to do with intervening variables such as urban

residence, husband's education, and family income than with a threshold level of basic scientific knowledge relevant to modern contraception (Cochrane 1979, 128-129). Unless more is learned about the effects of instruction on fertility beliefs and practices, explanations of school effects will continue to emphasize intermediate outcomes, providing only modest support for the long term social benefits of increasing access to education and raising levels of educational attainment. And they will be of little practical guidance to educators or educational policy makers.

Conclusion

This review was undertaken for the purpose of identifying important outcomes of schooling and what is necessary to achieve them. What has been learned?

1. Schooling may foster the adoption of modern values and beliefs, changing perceptions of self and society. Seven or more years of primary schooling seem to be required to produce significant attitudinal changes.

2. School literacy fosters profound cognitive changes in the ability to employ and manipulate formal logical structures in reasoning with and from printed texts. Four to six years of schooling are thought to be necessary to make literacy permanent. Literacy skills are not lost when an individual leaves school but the level of mastery of these skills in school will influence competence in literacy tasks in later life.

3. Schooling may increase productive capacities, by equipping individuals with skills valued in wage/salary employment and/or related to agricultural production that uses the products and processes of modern technology. Productivity increases are greatest for those with at least a primary education. Instruction in academic subjects may

be more effective than prevocational training insofar as employment and measures of productivity are concerned.

4. School participation improves health and lowers fertility mainly through strengthening the effects of other factors associated with schooling. High rates of school participation and relatively high levels of educational attainment (full primary and lower secondary schooling) are associated with reductions in fertility and infant mortality, and with increases in life expectancy.

But these findings do not add up to a strategy for optimizing educational investments in poor countries. Important school outcomes have been established. This is the chief contribution of more than twenty years of educational research in developing countries. It is the processes through which these effects occur that now require more careful study.

Expansion of schooling has been stressed in educational planning, notwithstanding qualitative evidence of diminishing school effectiveness (Heyneman and White 1986). Prescriptions for educational investment have often not taken into account their impact on instructional conditions because the mechanisms through which school experiences are transformed into school outcomes are still poorly understood. What is needed are approaches to assessing school outcomes that offer insights into how competencies are developed in school as well as into how school-acquired knowledge and skills are used in daily life.

The most insightful studies of the modernizing effects of schooling indicate that the attitudinal changes with which school experiences are associated can be realized only if the methods of instruction support the social changes which they are intended to facilitate. This insight is hidden in the correlational evidence

which has been assembled in favor of the powerful attitudinal influence of schooling in non-western societies. The assumption here is that schools exemplify the idealized features of a modern society. The correspondence between the rationalistic, secular, empirical, and egalitarian values that result from instruction and what actually takes place in classrooms is crucial to school effectiveness. Modernization research drew attention to the importance of the teacher though it did not establish which kinds of teaching or what teacher characteristics had the most impact on student attitudes. Alarmingly, teacher training was found in some studies to be among the least modern of modernizing educational experiences. Qualitative improvement of teacher training and supervision might increase the school's effectiveness in imparting new values and beliefs, but this must be carried out with a better understanding of who becomes a teacher and how teaching practices are influenced by instructional conditions.

Similarly, we have learned from studies of literacy that the circumstances under which literacy skills are developed and competency obtained largely determines whether they will endure and be useful in adulthood. Formulating policy objectives in terms of providing the number of years of schooling necessary to become literate misses the essential point. Unless children have an opportunity to practice reading in school, and understanding printed texts is made integral to instruction, they

are not likely to be literate in any meaningful sense nor are they apt to derive much benefit from being able to read.

Schooling may enhance productive capacities though it is unclear how this occurs. Instruction in academic subjects perhaps does have more importance for formal as well as informal employment than various forms of prevocational or vocational training. However, decisions about the length and content of instruction which are not informed by studies of how school knowledge and skills are used in work activities will not produce qualitative improvements in the labor force or make school leavers more employable.

Most countries do not choose between investing in primary or secondary education or between academic and vocational education on the basis of which investments bring the highest returns. Countries mix investments on the basis of what can be afforded, political pressures for expansion, and projections of manpower needs. Ultimately, decisions are guided by beliefs about the kind of training that will most benefit individuals and society. These are seldom substantiated with any evidence other than what labor surveys might reveal, and conjecture about the utility of schooling inferred from employment and earnings data. What job related skills are best acquired in school? Is formal instruction appropriate for imparting vocational skills? What is the role of literacy, numeracy, knowledge of science, and of other school subjects in the acquisition of technical competence? The answers to such questions have not emerged in the research

that has been reviewed nor are they likely to be obtained from studies which do not link estimates of the capacity increasing effects of schooling to an examination of how the social and technical competence associated with particular kinds of work is developed.

The profound effects of schooling on health and fertility seem supportive of efforts to increase educational attainment, especially among females. This is sometimes represented as a necessary but insufficient condition for increased life expectancy and lower fertility and infant mortality. Nevertheless, there is little evidence that more schooling will increase these effects even if other circumstances are reinforcing. Little is known about <u>how</u> schooling actually affects health and fertility behavior except in terms of propensities that individuals with certain levels of schooling may have in common. How, for example, does school knowledge influence the way school leavers think about the causes, prevention, and treatment of disease? Schooling is important in transmitting modern medical knowledge, specifically, in communicating information about health, nutrition, and fertility control practices. However, the way instruction in health and biology is imparted and learning outcomes assessed may have more impact on health status and fertility than either how much is taught or for how long.

While a great deal has been learned about the domains of thought and activity influenced by schooling, the connections to

school experiences are quite obscure. Most educational research in developing countries has tended to use input/output models for assessing the effects of instruction on learning, and measured external efficiency in terms of changes that can be correlated with schooling. Comparison of individuals with different levels of schooling with respect to important outcomes such as increased farm yields, for instance, may suggest gross school effects. But it will also reveal large within-group differences that may approach or exceed the differences based on the level of educational attainment.

Increasing access to schooling and raising levels of educational attainment will not magically lengthen life expectancy, increase productive capacities or bring about many of the other social and economic changes which are the objects of investments in schooling. It is what individuals learn in school rather than how long they attend school that is important. Present efforts to maximize the internal efficiency of schooling in developing countries focus on the manipulation of factors which influence the ways in which instructional resources are allocated and utilized at the school level and, in doing so, presumably affect learning (World Bank 1988). But the manipulation of instructional inputs such as teacher/student ratios, teaching responsibilities, preservice and inservice teacher training, frequency of school inspection, textbook distribution, and other factors that may affect classroom learning do not directly address a fundamental policy issue: what

instructional changes represent a qualitative improvement? For purposes of convenience and simplicity, educational researchers usually equate qualitative improvements with gains in outcome measures such as national examination scores. Achievement test results indicate what a student knows based on what someone has determined the student should have been taught. They do not provide many insights into the knowledge students may possess or into the cognitive strategies they use, or into the quality of instruction they have received or the importance of the knowledge and skills they might acquire for performing practical tasks in daily life.

Attention must be given to the content of school experiences. Policies having to do with the content of instruction address essentially normative concerns: what students should know on leaving school and how essential knowledge is best imparted. Policy research has generally avoided such issues except by implication and, as a result, neglected subjects that are central to the kind of decision making that actually influences educational practice and social and economic outcomes of schooling.

How much science, mathematics, agriculture, and health should be taught? How should such instruction be organized and information communicated and assessed? What provisions, if any, should be made in the school syllabus for practical experience? Are school effects on agricultural productivity and health status, for instance, more pronounced in countries in which

instruction in scientific subjects is given greater emphasis? Most developing countries have relied on the experience of more developed countries to determine what subjects are appropriate for instruction at the primary level and how instructional time should be allocated between them. Local innovations have taken the form of expansion of the school curricula. The result is a primary school syllabus that is often crowded by subjects like music, physical education, geography, and history, which are taught in primary schools everywhere, and innovations like agriculture, health science, home economics, and instruction in one or more metropolitan languages that are used at the secondary and higher levels. In Kenya, twelve subjects are taught in the final years of primary schooling. The effects of a crowded syllabus may be compounded by efforts to increase access to schooling through more intensive use of school facilities. For example, double shifts have often been introduced to expand enrollment without any reduction of the scope of instruction.

Crowding of the school syllabus might not be a serious concern were it not for the fact that children in rural areas in many developing countries acquire literacy, numeracy, and modern scientific knowledge from what they are taught in school. They do not watch educational television, read science fiction, or obtain much knowledge of modern science outside school. Moreover, learning activities in primary schools provide few opportunities for self-instruction. Rural children cannot be expected to do much homework. Even their teachers often do not

have access to lighted facilities for work after school hours. Issues related to the scope and methods of instruction are, thus, of much importance, and decisions about them are usually not informed by research.

Little is known about how instruction should be organized to facilitate the attitudinal, cognitive, and behavioral changes that have been the subject of much educational research. It is indeed remarkable how little descriptive literature exists about schools in any developing country despite the abundance of quantitative information about enrollments, school participation rates, the performance of students on national examinations and international tests of educational achievement, and on other subjects. Decisions relating to what length and kinds of instruction make the most efficient use of scarce human and material resources need to be informed by more detailed analyses of how schooling may contribute to individual and social change.

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